CLAIMS

What is claimed is:

1. A method of forming a semiconductor device, the method comprising:
providing a semiconductor substrate;
forming a gate dielectric material over the semiconductor substrate;
depositing a gate electrode material over the gate dielectric material, wherein the gate electrode material comprises a transition metal and an element selected from the group consisting of boron and carbon;
patterning the gate dielectric material to form a gate dielectric;
patterning the gate electrode material to form a gate electrode, wherein the gate electrode consists of the gate electrode material; and
forming current electrodes within the semiconductor substrate and laterally adjacent the gate dielectric.

2. The method of claim 1, wherein depositing the gate electrode material is performed by physical vapor deposition.

3. The method of claim 2, wherein depositing the gate electrode material is performed by reactive sputtering.

4. The method of claim 2, wherein depositing the gate electrode further comprises:
providing a target material, wherein the target material comprises the transition metal; and
flowing a process gas, wherein the process gas comprises carbon and nitrogen.

5. The method of claim 4, wherein the process gas comprises a gas selected from the group consisting of methane, ethane, propane and butane.

6. The method of claim 1, wherein the gate electrode material further comprises nitrogen.

7. The method of claim 1, wherein the gate electrode material comprises boron and carbon.

8. The method of claim 7, wherein the gate electrode material comprises nitrogen.

9. The method of claim 1, wherein forming the current electrodes are performed after forming the gate electrode.

10. The method of claim 1, further comprising exposing the gate electrode to temperature greater than approximately 700 degrees Celsius.

11. The method of claim 1, wherein forming the current electrodes comprises forming n-type regions.

12. The method of claim 1, wherein depositing the gate electrode material further comprises depositing a material selected from the group consisting of TaC, LaB_6, CeB_6, and PrB_6.

13. The method of claim 1,wherein depositing the gate electrode material further comprises depositing a material selected from the group consisting of metal carbides, metal borides, metal boro-carbides, metal boro-nitrides, metal carbo-nitrides and metal boro-carbo-nitrides.

14. A method of forming a semiconductor device, the method comprising:
providing a semiconductor substrate;
forming a gate dielectric material over the semiconductor substrate;
depositing a gate electrode material over the gate dielectric material, wherein the gate electrode material comprises a transition metal and an element selected from the group consisting of boron and carbon;
patterning the gate dielectric material to form a gate dielectric;
patterning the gate electrode material to form a gate electrode;
forming current electrodes within the semiconductor substrate and laterally adjacent the gate dielectric; and
forming a dielectric layer (94) over and in contact with the gate electrode.

15. The method of claim 14, wherein depositing the gate electrode material is performed by physical vapor deposition.

16. The method of claim 15, wherein depositing the gate electrode material is performed by reactive sputtering.

17. The method of claim 15, wherein depositing the gate electrode further comprises: providing a target material, wherein the target material comprises the transition metal; and flowing a process gas, wherein the process gas comprises carbon and nitrogen.

18. The method of claim 17, wherein the process gas comprises a gas selected from the group consisting of methane, ethane, propane and butane.

19. The method of claim 14, wherein the gate electrode material further comprises nitrogen.

20. The method of claim 14, wherein the gate electrode material comprises boron and carbon.

21. The method of claim 20, wherein the gate electrode material comprises nitrogen.

22. The method of claim 14, wherein forming the current electrodes are performed after forming the gate electrode.

23. The method of claim 14, further comprising exposing the gate electrode to temperature greater than approximately 700 degrees Celsius.

24. The method of claim 14, wherein forming the current electrodes comprises forming n-type regions.

25. The method of claim 14, wherein depositing the gate electrode material further comprises depositing a material selected from the group consisting of TaC, LaB_6, CeB_6, and PrB_6.

26. The method of claim 14,wherein depositing the gate electrode material further comprises depositing a material selected from the group consisting of metal carbides, metal borides, metal boro-carbides, metal boro-nitrides, metal carbo-nitrides and metal boro-carbo-nitrides.

27. A semiconductor device comprising:
a semiconductor substrate;
a gate dielectric over the semiconductor substrate;
a gate electrode over the gate dielectric material, wherein the gate electrode material comprises a transition metal and an element selected from the group consisting of boron and carbon;
current electrodes within the semiconductor substrate and laterally adjacent the gate dielectric; and
a dielectric layer (94) over and in contact with the gate electrode.

28. The method of claim 1, wherein the gate electrode material further comprises nitrogen.

29. The method of claim 14,wherein depositing the gate electrode material further comprises depositing a material selected from the group consisting of metal carbides, metal borides, metal boro-carbides, metal boro-nitrides, metal carbo-nitrides and metal boro-carbo-nitrides.

30. The method of claim 14, wherein depositing the gate electrode material further comprises depositing a material selected from the group consisting of TaC, LaB_6, CeB_6, and PrB.

31. The semiconductor device of claim 27, wherein the gate electrode is a gate electrode for a NMOS transistor.

32. A method for forming a semiconductor device, the method comprising:
providing a semiconductor substrate;
forming a gate dielectric material over the semiconductor substrate;
forming a gate electrode material having a predetermined work function comprising:
flowing a precursor, wherein the precursor comprises nitrogen and carbon;
adjusting a ratio of nitrogen to carbon in while flowing the precursor to achieve the predetermined work function;
patterning the gate dielectric material to form a gate dielectric;
patterning the gate electrode material to form a gate electrode;
forming current electrodes within the semiconductor substrate and laterally adjacent the gate dielectric; and
forming a dielectric layer over and in contact with the gate electrode.

33. The method of claim 32, wherein adjusting the ratio of nitrogen to carbon further comprises decreasing the ratio of nitrogen to carbon.